

1971

The Relationship Between Fixed Ratio Schedules of Reinforcement and Aggression in Children.

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71-20,614

PETERSON, Gerald LeRoy, 1944-

THE RELATIONSHIP BETWEEN FIXED RATIO SCHEDULES
OF REINFORCEMENT AND AGGRESSION IN CHILDREN.

The Louisiana State University and Agricultural
and Mechanical College, Ph.D., 1971
Psychology, clinical

University Microfilms, A XEROX Company, Ann Arbor, Michigan

THE RELATIONSHIP BETWEEN FIXED RATIO SCHEDULES OF
REINFORCEMENT AND AGGRESSION IN CHILDREN

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

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January, 1971

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to all those whose help and support have made this research possible.

He wishes to thank Dr. Edwin O. Timmons for his continual encouragement, guidance and valuable assistance that made this study possible.

To Dr. Bill Seay, Dr. Ralph Dreger, Dr. Laurence Siegel and Dr. William Haag he expresses his sincere appreciation for their suggestions and guidance in the preparation of this study.

The writer is grateful to the directors, teachers, and children of the University Methodist Nursery School in Baton Rouge, Louisiana, whose cooperation and assistance made it possible for the data to be collected.

He wishes to thank Miss Karen Calhoun for her continual support and Mrs. Jewel Osbey for her typing of the original manuscript.

The author wishes to thank Mrs. Mary Mevers for her excellent typing of the completed dissertation.

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ABSTRACT

Two experiments using 24 pre-school children were performed in an attempt to determine if results of aggression-inducing properties of schedules of reinforcement on animals were generalizable to children. Both experiments utilized a lever press task and a Bobo doll as the target for aggression. Length of time spent aggressing was the dependent variable. In Experiment I where 8 males were reinforced 10 times at levels CRF, FR10, FR25, FR50, FR25, FR10, and CRF only one S aggressed and then only at the FR50 and FR25 levels. In Experiment II schedules were built to FR50 as rapidly as possible comparing 8 boys vs 8 girls. Eight of the 16 Ss aggressed; the peak aggression occurred at FR50. Although boys and girls were not significantly different at the FR50 level the boys were significantly more aggressive during the final baseline. It was concluded that high or "straining" FR schedules are capable of inducing aggression equally in boys and girls. Aggression appears to be a function of speed of transition to higher level schedules as well as the response requirements of various high level schedules of reinforcement.

INTRODUCTION

Almost since Psychology's inception, aggression has been a focus of attention. Why one human or animal behaves aggressively toward another has been attributed to a number of things. Among these are:

Instinct (Lorenz, 1966);

Drive (Freud, 1921; Bender, 1953; Redl, 1957);

Child rearing (Sears, Whiting, Nowlis, and Sears, 1953);

Frustration (Dollard, Doob, Miller, Mowrer and Sears, 1939;

Miller, 1941; Dollard, 1944);

Instrumental responding (Skinner, 1959; Buss, 1961; Patterson,

Littman and Bricker, 1967);

Modeling (Bandura and Walters, 1963);

Aversive stimulation (Ulrich and Azrin, 1962; Azrin, Hutchinson

and Hake, 1963; Azrin, Ulrich, Hutchinson and Norman,

1964; Azrin, Hutchinson and Sallery, 1964; Azrin,

Hutchinson and McLaughlin, 1965; Azrin, Hake, and

Hutchinson, 1965; Boshka, Weisman and Thor, 1966);

Extinction (Gallup, 1965; Thompson and Bloom, 1966; Azrin,

Hutchinson and Hake, 1966; Davis and Donenfeld, 1967); and

Schedules of reinforcement (Hutchinson, Azrin and Hunt, 1968;

Gentry, 1968; Gentry and Schaeffer, 1969; Flory, 1969;

Knutson, 1970).

The concept of an instinct or drive as the basis for aggression

has been put forward on the one hand by Lorenz (1966) and, on the other, by Freud and his psychoanalytic followers (Ross and Abrams, 1965).

Lorenz sees aggressive behavior as functional in the preservation of the species. Although the aggressive instinct can be suppressed to some extent by ritualistic behavior, it still exists in a full blown state in a particular animal or human and is ready to be set off by the appropriate stimulus.

Freud (1921) and his followers (Ross and Abrams, 1965) also postulate an aggressive instinct although it is decidedly different from that proposed by Lorenz. In Freudian theory, while the sexual instinct is of primary importance, aggression came to be regarded as the second major instinct and his later writings discuss the life instinct (Eros) and death instinct (Thanatos). In this dual instinct theory, aggression served as an external manifestation of an internally directed self destructive tendency (Thanatos). Aggression itself is referred to in a variety of ways, raising the question of definition. Freud and his followers discuss aggression in a number of different ways: as achieving discharge in neurotic symptoms, as being self critical and punitive in the super-ego component, as sublimation leading to control over nature, and as fusing with the libido to produce significant developmental and pathological phenomena (Freud, 1930; Ross and Abrams, 1965). Such a formulation of aggression makes it very difficult to empirically test the concept.

Both Lorenz' and Freud's concepts of aggression presuppose a reservoir of instinctual aggressive energy seeking outlet. Berkowitz

(1967), in a number of studies on aggression, showed that such a conceptualization could not explain his data. He found that aggression occurred only when certain stimulus events were present, and then only under specifiable conditions.

A similar approach to that of Freud and Lorenz has been that of physiologists who attempted to determine the physiological determinants of aggressive behavior. Beach (1945) and Beeman (1947) found a direct relationship between hormonal balance and fighting behavior. However, several studies since that time have downgraded the importance of this variable. Bevan, Daves and Levy (1960) showed that testosterone is less effective in producing fighting behavior in rats than is previous fighting experience. Scott and Fredericson (1951) indicated that hormonal factors are unimportant in fighting behavior following its acquisition. Scott (1958) successfully trained mice not to fight and concluded that the concept of a fighting instinct in mammals is unjustified. McNeil (1959) extended this conclusion to human beings, suggesting that the explanation of human aggression is not furthered by invoking genetic or physiological factors.

Thus, although early experiments, observations and speculations suggested an instinctual or drive theory of aggression, these have not been supported by later developments and alternative explanations have been developed. Probably the most famous of these was the Frustration-Aggression (F-A) hypothesis of Dollard, Doob, Miller, Mowrer and Sears (1939) which developed from Freud's earlier writings. The F-A hypothesis defined frustration as "that condition which exists when a

goal-response suffers interference" (p. 11) and aggression as "an act whose goal response is injury to an organism (or organism surrogate)" (p. 11). Their hypothesis suggested a one-to-one relationship between frustration and aggression, that is "aggression is always a consequence of frustration" (p. 1), and "the existence of frustration always leads to some form of aggression" (p. 1). Later modifications of the hypothesis regarded aggression as the naturally dominant but not necessarily inevitable consequence of frustration (Miller, 1941; Dollard, 1944). Thus nonaggressive behavior might occur if previous aggressive responses had been unrewarded or punished. However, frustration continued to be conceptualized as the inevitable antecedent of aggression.

Opposition to the hypothesis arose from numerous sources. Bateson (1941) showed that cross-culturally this hypothesis was not workable. In some cultures such as the Balinese, aggression was not the typical response to frustration. Others (Barker, Dembo and Lewin, 1941; Wright, 1942, 1943) have shown that responses such as regression may result from frustration. Likewise, results from other studies (Maslow, 1941; Rosenweig, 1944; Buss, 1961) have shown that attack or threat is more likely to result in aggression than is simply blocking an ongoing response-sequence.

Although the F-A hypothesis may have limited applicability, it cannot account for a great deal of aggression as was originally intended. In an attempt to further the understanding of aggression, new approaches have been formulated.

Bandura and Walters (1963) have reformulated the definitions of

aggression and frustration and by so doing, the F-A hypothesis. They see aggression as "the class of pain-producing or damage-producing responses, or as responses that could injure or damage if aimed at a vulnerable object" (p. 366). Frustration was viewed as "a delay of reinforcement" (p. 367). In their review of aggression, frustration is seen as neither a necessary nor sufficient cause for aggressive behavior to occur. The more important antecedents of aggression were seen as past behavior with respect to prior reinforcement for aggression, and exposure to aggressive models. The role of frustration appears to be that it may elicit high magnitude responses which may be labeled aggressive if they are directed toward another person or animal. A study by Walters and Brown (1964) supports this hypothesis. Under two separate conditions, kindergarten through second grade boys were trained to hit a Bobo doll with high or low intensity. A second group was trained on a lever press which activated a ball in an enclosure. The boys in this group were trained to activate the lever with high or low intensity (i.e., under high intensity conditions the boys were rewarded for pressing the lever hard enough for the ball to hit the top of the enclosure). The subjects were then allowed to play games, likely to elicit aggression, with another child. Both groups of boys trained under high intensity were significantly more aggressive (as rated by frequency of displayed aggressive behavior) than boys trained under low intensity conditions. The authors point out that it was unlikely that frustration in the training conditions accounted for this difference in performance because although high intensity children trained on the Bobo

doll were reinforced for only 1 out of 12 responses and low intensity boys were reinforced for 1 out of 8 responses, the reverse was true for the lever press group.

Support for the contention that modeling and previous history of reinforcement are more important variables in the display of aggressive behavior than is frustration have come from a number of sources. Bandura and Huston (1961) showed that preschool children exposed to a model who performed aggressive acts displayed significantly more aggressive behavior than did a control group exposed to the same model but without the demonstration of aggressive behavior. Half of the experimental group had experienced two periods of rewarding interaction with the model while the other half spent two periods of time with the model but without interacting with her. Although the rewarded group imitated more of the model's behavior, both groups showed a high incidence of aggression in relation to the control group, suggesting that merely observing an aggressive model is sufficient to produce aggressive behavior in children. Bandura, Ross and Ross (1961) extended this finding by showing that aggressive imitative responses developed in the presence of a model generalize to settings in which the model is absent. In another study (Bandura, Ross and Ross, 1962) they showed that film-mediated aggressive modeling led to aggressive behavior in the observing children.

In a somewhat related study by Schacter and Singer (1962), subjects injected with epinephrine and not informed of its physiological side effects displayed considerably more aggressive behavior toward

an aggressive confederate than a group similarly injected and informed of the side effects. Bandura and Walters (1963) interpret these results as suggesting that the influence of models is more potent under emotional arousal especially when the subjects cannot attribute their feelings to anything other than a model's behavior.

Bandura and Walters (1963) conclude that observation of modeling behavior has two different effects: 1) the observer may acquire new responses that did not previously exist in his behavior repertory, or 2) observation of aggressive models may weaken inhibitory responses. Under this second condition behavior which the model exhibits already exists in his behavior repertory and may be nonimitative in nature.

Reinforcement of aggressive behavior is seen by Bandura and Walters (1963) as the second important variable in current aggressive behavior. A number of studies have demonstrated its importance. Davis (1943) and Davis and Havighurst (1947) reported that lower class parents encourage and reward aggression to a greater extent than do middle class parents, thus perhaps accounting for the higher incidence of aggressive behavior in the lower classes. Bandura and Walters (1959; 1963) discovered that parents of aggressive boys encouraged and condoned aggressive behavior more than parents of non-aggressive boys.

In addition to parental importance in shaping aggressive behavior, Patterson, et al. (1967) have shown the influence of peer behavior. In one of the few aggression studies with children done outside the laboratory, Patterson sent into two nursery school settings a corps of observers who transcribed behavioral events and their

consequences. In later analyses of these data he was able to show that much of the aggressive behavior was being reinforced by peers at a very high level and was thus being maintained. Based on his results a subsequent experiment was performed showing that aggressive behavior could be predicted quite accurately if knowledge of the immediately previous aggressive behavior and its consequences were known.

Several other studies have been done showing the effects of reinforcement of aggressive responses. Cowan and Walters (1963) found that reinforcing boys for aggressive behavior on three different schedules of reinforcement (CRF, FR3, FR6) resulted in typical extinction curves, that is, CRF boys extinguished the fastest and the FR6 boys took the longest time to extinguish. In another study, Walters and Brown (1963) used four conditions: an FR6 and a CRF schedule of reinforcement for hitting a Bobo doll and a no training group. The results showed that the FR6 group exhibited the greatest amount of aggressive behavior and was significantly different from the other three groups who did not differ significantly from one another. An additional variable, frustration-nonfrustration, made no difference in the amount of aggression exhibited.

Although it appears that a great proportion of aggressive behavior can be accounted for by the influence of models and operant conditioning, other studies have shown the importance of aversive stimulation in eliciting aggression. This phenomenon was first described by O'Kelly and Steckle (1939) and has more recently been confirmed and expanded (Ulrich and Azrin, 1962). Aversive stimulation

has been shown to elicit aggressive behavior from a variety of species (Ulrich & Azrin, 1962; Azrin, et al., 1963); Ulrich, Hutchinson and Azrin, 1965). The aversive stimulus may be of an exteroceptive nature such as foot shock, heat (Ulrich and Azrin, 1962) or tail pinch (Azrin, et al., 1965), or it may be interoceptive such as morphine withdrawal (Boshka, et al., 1966).

Ulrich and Azrin (1962) conclude from their studies that the aggression exhibited was not of an operant nature (shock resulted in attack rather than leaning or climbing on other animals to eliminate the shock), nor was it superstitious, as continuous delivery of shock produced attack behavior. Azrin, et al., (1964) regard the pain-aggression reaction as a type of reflexive reaction and not as a response maintained by operant reinforcement.

More recent investigations have suggested that extinction and non-reinforced trials are sufficient to result in aggressive behavior with paired organisms. Rats will attack one another in a straight alley on non-reinforced trials (Gallup, 1965). Thompson and Bloom (1966) and Davis and Donenfeld (1967) report that rats placed on extinction following a CRF schedule of reinforcement will aggress. Azrin, et al., (1966) showed that aggressive behavior during extinction was not specific to rats but extended to pigeons as well.

Since one of the characteristics of intermittent schedules of reinforcement are periods of non-reinforcement, Azrin, et al., (1966) suggested that intermittent schedules of reinforcement might elicit aggressive behavior between pairs of subjects. This hypothesis has been

supported by a number of studies. Gentry (1968), Flory (1969) and Knutson (1970) found marked aggression in pigeons using relatively high (40-120) FR schedules of reinforcement. Gentry and Schaeffer (1969) found this effect to be present in rats, while Hutchinson, et al., (1968) found that squirrel monkeys exhibited aggressive responses toward a pneumatic hose when subjected to high requirements of FR responding.

The purpose of the present study was to determine whether aggressive behavior resulting from high response requirement FR schedules of reinforcement are generalizable to human subjects. This was accomplished by using pre-school children in an experimental situation requiring varying numbers of lever press responses and utilizing a Bobo doll as a target for aggression. The findings of this study should result in added information to our knowledge of aggressive behavior. The results should also be helpful in the study of children and the treatment procedures used with them. If, for example, a therapist is seeing an aggressive child he might look at the schedules of reinforcement the child is receiving in addition to other antecedent conditions known to elicit aggression. For behavior modifiers, especially, the understanding of the interaction between schedules of reinforcement and the presence of stimuli in the environment is essential for adequate treatment.

METHOD

Experiment I

Subjects

The Ss were 8 five year old nursery school boys.

Apparatus

The experimental chamber was a screened-off portion of a larger room. The chamber contained a small chair, a small table, the stimulus-reinforcement box and a Bobo doll. The doll was contained in a three sided, box-like enclosure. The control room also located in the larger room contained the stimulus-reinforcement box control panel and an Esterline Angus 20 channel event recorder connected with the stimulus-reinforcement box and the Bobo doll enclosure.

The stimulus reinforcement box was a black box 19" x 11" x 15" with a round stimulus light on the front panel. Directly below the stimulus light was the manipulandum, a key which must be pressed by Ss. Four inches to the left of the key was a reinforcement chute and a plexiglas reinforcement catch box.

The Bobo doll enclosure was a 24" x 30" x 24" three sided box with the front side open. The doll was placed in the front part of the box, facing outward. Immediately behind the doll, on the floor of the box was a 6" restraining wall which kept the doll from moving around the enclosure excessively.

The control panel of the stimulus-reinforcement box contained a switch for the stimulus light, a switch which determined the schedule of reinforcement and a reinforcement reset button that controlled the dispensing of the reinforcement. The event recorder, which recorded the number of lever presses, reinforcements and amount of time spent aggressing was also placed in the control room.

Procedure

Initial pilot work indicated that displacements of the doll's head would be an appropriate measure of aggression. Later pilot work showed however, that this index was not sufficient, for other aggressive responses such as wrestling and pinching were not automatically recorded by the apparatus. In order to take these additional behaviors into account it was decided to use time spent in aggression as the dependent variable rather than displacements of the doll's head. E observed S through the screen and made a mark on the event recorder paper when E judged aggression had begun and again when aggression terminated. Responses labeled "aggressive" were based on the categories reported by Walters and Brown (1964) and included, elbowing, kicking, punching and pushing. In addition to these wrestling and squeezing or pinching were included.

Each S was placed in the experimental chamber in front of the stimulus-reinforcement box with the Bobo doll on the side of his preferred hand for 3 minutes with the stimulus light darkened and the response key inoperative. During this time the event recorder was active and a baseline rate of hitting responses was recorded.

Following the time allowed for baseline recording, S was taken from the experimental chamber and shown a number of items such as, coloring books, small toy cars and trucks, kites, play dough, coupons which could be redeemed at a local ice cream store, etc., and told that if he worked real hard he could win one of the items. S was then reintroduced to the experimental chamber and told that he would earn some marbles which he could trade for the toys he had already seen. S was seated in front of the stimulus reinforcement box with the Bobo doll on the side of his preferred hand. E demonstrated how S could earn the marbles by pressing the key below the stimulus light and receiving a marble. E then left the chamber and returned to the control panel. S was told to begin and was successively programmed through CRF, FR10, FR25, FR50, FR25, FR10, CRF and a 3 minute baseline period. Each schedule was continued until S received 10 reinforcements, at which time the schedule was increased to the next FR requirement. The amount of time spent in aggression was recorded for each schedule. During the final baseline period the stimulus light was again darkened and the response key inoperative. The event recorder remained operative.

RESULTS

Experiment I

The various levels of FR response requirements in this experimental situation failed to elicit aggression, as previously defined, in all children but one. The one child who aggressed did so as predicted; that is, he exhibited aggressive behavior at the higher FR schedules (FR50, FR25) rather than during the lower ones. In addition, one other child left the experimental chamber during FR50 but returned and completed the task. No other children displayed aggressive behavior at any time during the experimental sessions.

Two Ss could not be used in the data analysis and were replaced because they failed to respond beyond the FR10 level. This failure made it impossible to build the higher schedules necessary for this study. These two Ss did, however, display aggressive behavior at the FR10 level following no aggression during either the baseline or CRF segments.

METHOD

Experiment II

Subjects

The Ss were 8 five year old nursery school boys and 8 five year old nursery school girls.

Apparatus

The apparatus was the same as that described in Experiment I.

Procedure

The baseline and demonstration of equipment was identical to that described in Experiment I. Each S was then progressively shaped to respond to an FR50 schedule of reinforcement. Typically a S was reinforced two or three times during CRF, FR2, FR3, FR4, FR5, FR10, and FR25 schedules. The schedule was increased only when a consistent rate of responding occurred. Although practically no aggression was elicited in Experiment I, previous animal studies (Gentry, 1968; Knutson, 1970) have shown that FR50 schedules of reinforcement are sufficiently high to induce aggression. Each S received 20 reinforcements on this schedule followed by a 3 minute baseline during which the stimulus light was darkened and the response key inoperative. During this time the event recorder remained in operation.

Analysis

The data were analyzed with a t-test, as suggested by Hayes (1963),

to test differences between the two groups. The dependent variable to be analyzed was the amount of time spent aggressing during the schedule under study. A .05 level of significance was accepted as showing an effect.

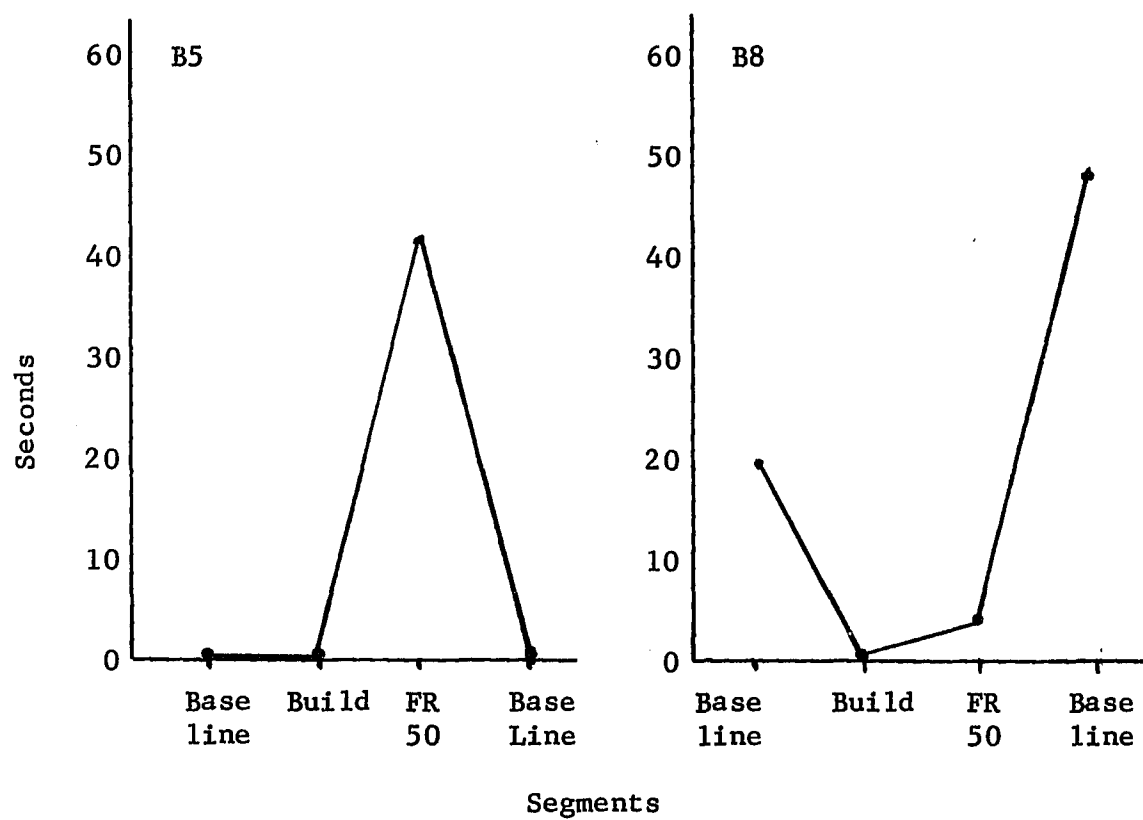
RESULTS

Experiment II

Aggression was elicited from eight of 16 Ss in Experiment II. Among the eight were wide individual differences in both amount of aggression displayed and the point at which peak aggression occurred. These differences can be seen in Figure 1 where individual performances are presented.

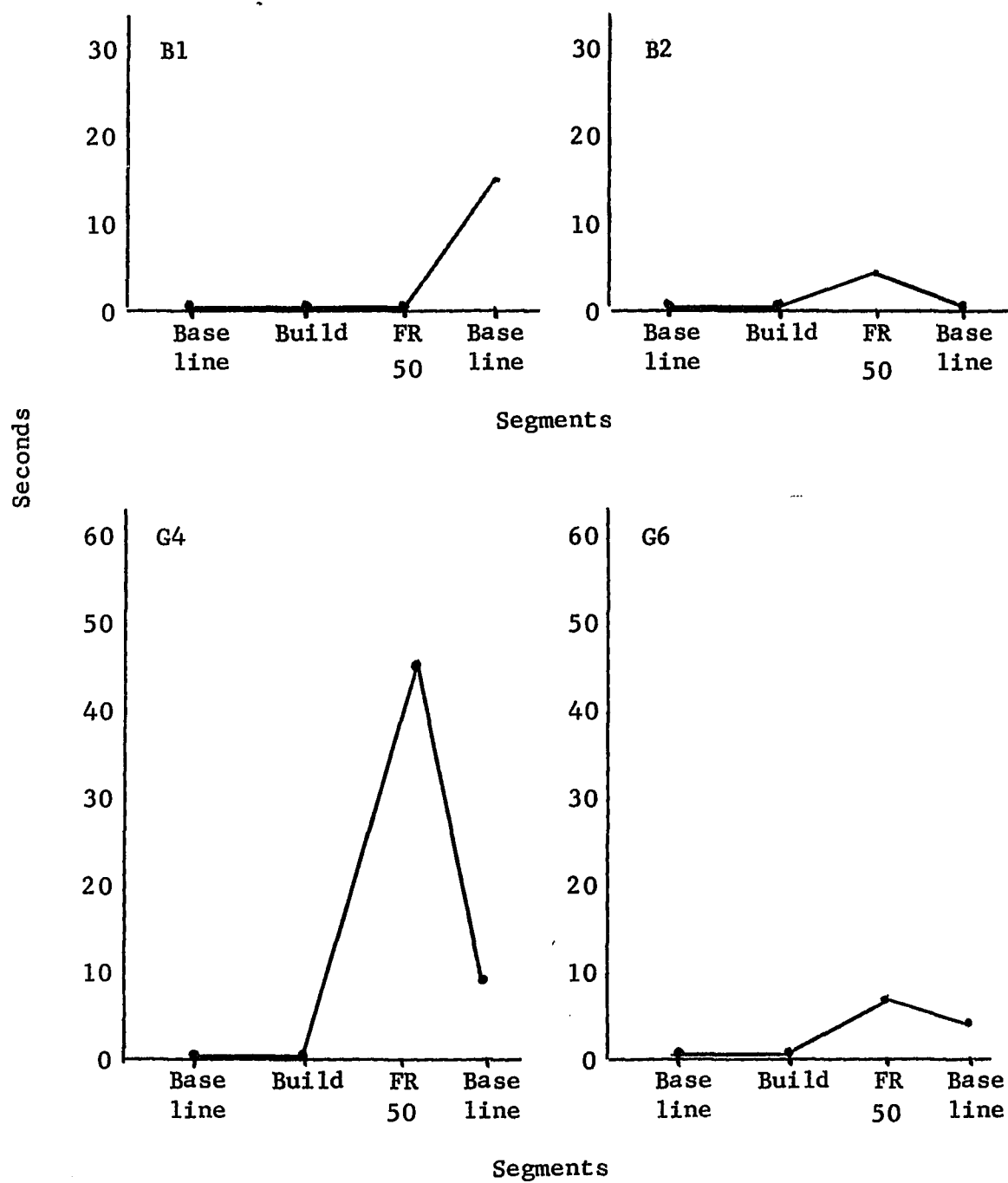
In the pre-treatment baseline period the boys were slightly more aggressive than the girls. Two boys aggressed for a total of 26 seconds while no girls aggressed during this time.

The schedule building portion of this experiment also induced only minimal aggression. No boys and only one girl aggressed during this period. The Ss varied widely in the number of responses necessary to reach a steady rate of responding. The range of responses are found in Figure 2. Responses ranged from 95 to 191 with a mean for the girls of 131.5 and for the boys 127.3. The range of reinforcements received for each S are shown in Figure 3. The total number of reinforcements received varied from 13 to 23, with the girl's mean 17.5 and the boy's mean 18.5. As can be seen Ss who aggressed ranged from the least number of lever presses before the FR50 segment to the greatest number of responses. They also ranged from the least to the greatest number of reinforcements.



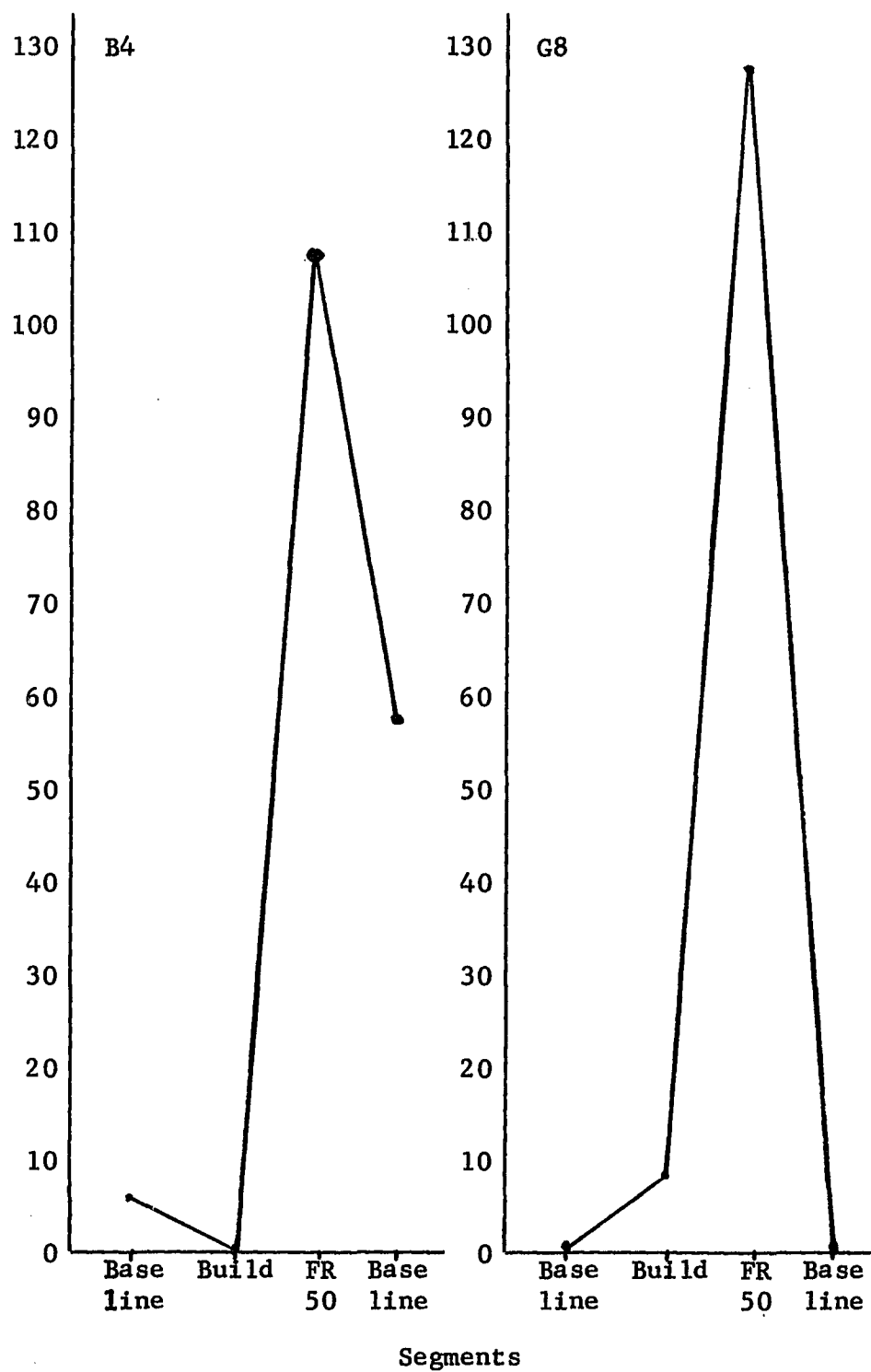
Amount of Time Spent in Aggression for Eight Aggressing Subjects

Figure 1.



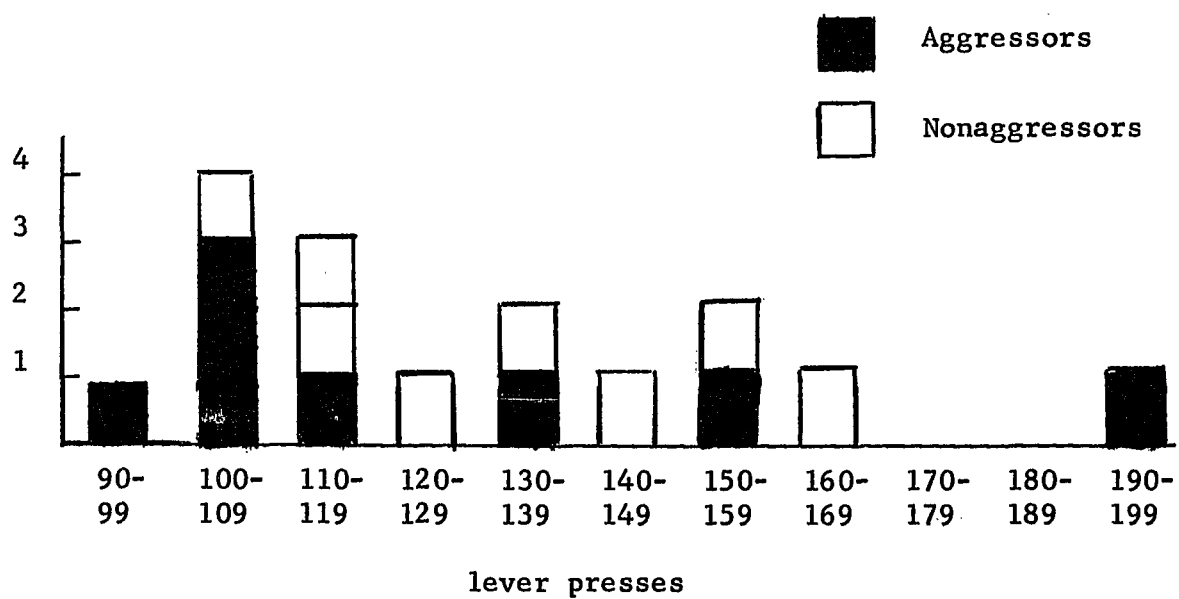
Amount of Time Spent in Aggression for Eight Aggressing Subjects

Figure 1 (Continued)



Amount of Time Spent in Aggression for Eight Aggressing Subjects

Figure 1 (Continued)



Number of pre-FR50 Lever Presses

Figure 2

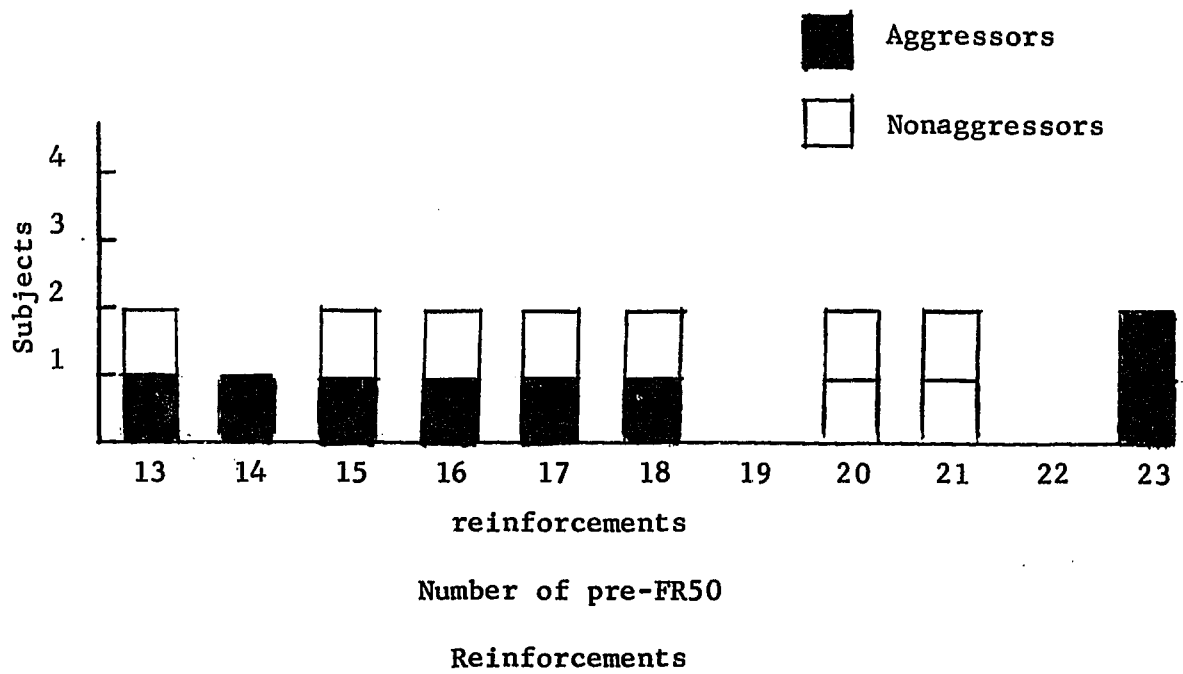
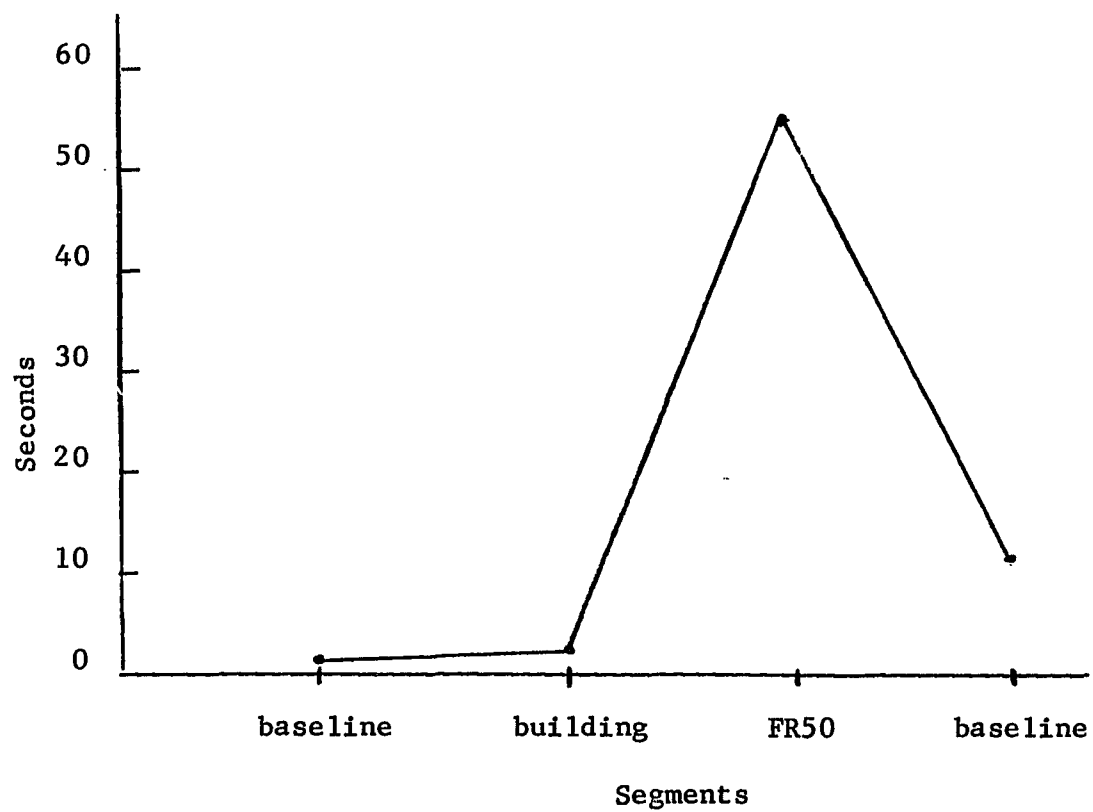


Figure 3

During the FR50 segment of the experiment four boys and three girls aggressed. One of the four boys hit the stimulus-reinforcement box rather than the Bobo doll but, because of the similarity of responses, was included in the aggressive group. For six of the seven children peak aggression was displayed during this segment. Figure 4 shows the average amount of time spent in aggression by this group for each segment of the experiment. The length of time spent in aggression during the FR50 segment was analyzed twice and the results are presented in Table 1. In the first comparison all Ss were used. A t-test was performed and no significant differences between boys and girls were found. A second t-test was performed on the amount of time spent in aggression of only the Ss who aggressed, and again no significant differences were found between boys and girls.

Subjects who aggressed during the FR50 segment varied as to the point at which aggression began. Two Ss commenced aggressing before the first reinforcement was dispensed, one S began aggressing between the second and third reinforcement, two Ss began between the third and fourth reinforcement, one began following the fourth reinforcement and one S waited until 12 reinforcements had been presented before aggressing. The location of the aggression was largely during the S's response run. One S aggressed only during the post-reinforcement-pause and one S combined aggression during the post-reinforcement-pause with aggression during the response run. All other Ss who aggressed did so during the response run itself.

Boys were found to be significantly more aggressive than girls



Average Amount of Time Spent Aggressing for
Subjects with Peak Aggression at FR50

Figure 4

TABLE 1
T-TEST OF AMOUNT OF TIME SPENT IN
AGGRESSION DURING FR50

Group	N	Mean	Standard Deviation	t
All Subjects				
Girls	8	22.3	41.8	.51 (NS)
Boys	8	19.5	33.9	
Aggressors				
Girls	3	59.3	49.6	2.23 (NS)
Boys	4	39.0	42.3	

during the post-baseline period. This difference is shown in Table 2 where the results of the t-tests between all Ss and between aggressors only are shown.

Although only four boys exhibited aggression during the FR50 segment of the experiment, two others indicated that they wanted to hit the doll during the FR50 segment but failed to do so because of their desire to earn enough marbles to obtain a toy.

One female S never reached a level rate of responding beyond FR5 and was replaced for the data analysis.

In summary, aggression was elicited from eight of 16 Ss during this experiment. Six Ss (three boys and three girls) showed peak aggression during the FR50 schedule. The remaining two male Ss aggressed most during the final baseline segment. Most of the aggression commenced early in the FR50 schedule and usually occurred during the response run.

TABLE 2
T-TEST OF AMOUNT OF TIME SPENT IN
AGGRESSION DURING FINAL BASELINE

Group	N	Mean	Standard Deviation	t
All Subjects				
Girls	8	1.8	3.4	4.30*
Boys	8	14.9	23.0	
Aggressors				
Girls	2	7.0	3.0	3.97*
Boys	3	36.3	17.7	

* p .05

DISCUSSION

It was shown that high FR schedules of reinforcement are capable of inducing aggression in children. The extent of the generalization at this point is still unknown as a human surrogate was used as a target for aggression. The results are, however, consistent with previous animal studies and suggest that their findings may have wider implications than the results of the present study warrant.

Experiment II showed that relatively high FR schedules of reinforcement will elicit aggression toward human surrogates from some Ss. No consistent differences were found between those Ss who aggressed and those who did not. Although individual Ss varied a great deal as to the number of pre-FR50 lever presses and reinforcements, aggressive Ss varied from the least number lever presses and reinforcements to the greatest number of each and it is unlikely that this variable accounted for the differences in elicited aggression.

The fact that only eight of 16 Ss aggressed is in agreement with previous animal studies. Gentry (1968) found that with live pigeon targets, only two of three experimental birds aggressed. Gentry and Schaeffer (1969) found that one of four pairs of rats failed to display aggression under different schedules of reinforcement. Knutson (1970) found that only one of five of his experimental birds would attack a stuffed pigeon. Pain-induced aggression also failed to produce aggressive behavior toward inanimate objects for all

rats (Ulrich and Azrin, 1962) or for all squirrel monkeys (Azrin et al., 1964; Azrin, et al., 1965).

Sex differences also failed to discriminate aggressors from non-aggressors. Previous studies (Bandura et al., 1961; 1963(a); 1963(b)) have shown that boys display significantly more aggression than girls. The present study only partially supports these findings. Although boys were slightly more aggressive during the initial baseline period, there were no significant differences between boys' and girls' aggressive behavior during the FR50 schedule of reinforcement. During the post-reinforcement baseline period however, the boys were significantly more aggressive than the girls. This suggests that high FR schedules of reinforcement are capable of eliciting aggression without respect to sex. When this condition is removed however, boys continue to display somewhat more aggression.

Although previous animal studies of the aggression inducing properties of schedules of reinforcement have dealt only with male ss, the initial study (Ulrich and Azrin, 1962) of the effects of aversive stimulation on aggression showed no sex differences in amount of aggression displayed. It has been shown that high response requirement schedules of reinforcement can be considered aversive (Azrin, 1961). Thus it is not surprising that no sex differences were found in the present study.

Two different patterns of aggressive behavior, peak aggression during FR50 and peak aggression during the post-reinforcement baseline period were found in the present study. This finding is also consistent

with the animal literature. The greatest amount of aggression (six Ss) occurred during the FR50 segment of the experiment and supports the results of Gentry (1968), Hutchinson, et al. (1968), Flory (1969) and Knutson (1970).

Azrin, et al. (1966) have shown that extinction following CRF will result in aggressive behavior. Hutchinson, et al. (1968) suggested that an intermittent reinforcement history might result in greater attack during extinction than a CRF history. Knutson (1970) found only one S that showed increased aggression during extinction with increased FR response requirements. One S showed no change in extinction elicited aggression and three Ss displayed less extinction-elicited aggression with increased FR response requirements. The present study's post reinforcement baseline period was very similar to the extinction procedure described by Knutson (1970) and similar results were obtained. Two Ss showed increased post reinforcement baseline (extinction) aggression while six Ss showed reduced post reinforcement baseline (extinction) aggression.

Experiment I, with the exception of one S, failed to elicit aggression, while eight of 16 Ss in Experiment II aggressed. The different conditions involved in these experiments may account for this difference. One difference was that the FR50 segment of Experiment II was lengthened to 1000 responses and 20 reinforcements. The data show that only one S of seven who aggressed during the FR50 schedule commenced aggression following the twelfth reinforcement. The remaining six Ss began aggressing well before the tenth reinforcement. A

second major difference was the way in which the FR50 segment was reached. In Experiment I schedules were gradually raised from CRF to FR10, FR25, and FR50. The schedules were then gradually returned to CRF in reverse order. In Experiment II the schedules were build as rapidly as possible. This difference resulted in a differential of both pre-FR50 responses and reinforcements. In Experiment I each S responded 360 times and received 30 reinforcements before reaching the FR50 schedule. In Experiment II the pre-FR50 responses ranged from a low of 95 to a high of 191, while the reinforcements varied from 13 to 23. Thus in terms of both responses and reinforcements, Ss in Experiment II went through a much more rapid transition than those in Experiment I.

Ferster and Skinner (1957) have shown that rapid transition from CRF to higher FR levels result in strained responding at the higher levels with individual Ss. It is possible that when even surrogate humans are in an individual's environment, aggression rather than simply strained performance is the result of rapid transition from a lower FR requirement to a higher one and the subsequent response requirements at the higher FR schedule. This is supported by Knutson's (1970) findings that the introduction of a target bird into the experimental chamber resulted in extremely strained performance by the experimental pigeon in addition to the time spent aggressing. These findings suggest that much more attention must be given to the importance of the interaction between schedules of reinforcement and the environment affecting a particular S.

The present study shows that aggressive behavior may occur in young children as the result of high response requirements on an FR schedule of reinforcement and thus may account for some of the aggressive actions observable in human behavior. Although Bandura and Walters (1963) and Patterson (1967) have shown that a great deal of aggression in children can be accounted for by the effects of modeling and peer reinforcement, it is probable that a certain amount remains unaccounted for. How much aggression can be accounted for by straining schedules of reinforcement account for is still unknown; however, this study has shown that aggression may very well be the result of high response requirement schedules of reinforcement and further study is warranted.

The present study only attempted to determine if the results of animal studies of schedule of reinforcement-induced aggression were generalizable to children. The results obtained are consistent with the findings of previous studies in this area. Further study is now necessary to determine what the parameters of schedule of reinforcement-induced aggression are. Studies comparing different groups of people would appear in order. Also more extended work should be done with respect to the schedules themselves. Higher ratio schedules could be used as well as temporal types of schedules. In addition the FR schedules should be run over a longer period of time using numerous conditioning sessions.

Ultimately, studies should be done in a more naturalistic setting. A particular child could be singled out and one aspect of his behavior

reinforced at a rate equivalent to FR50 or higher and the amount of aggression exhibited toward other children recorded. In this way the practical aspects of this knowledge can be more fully evaluated.

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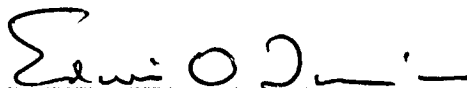
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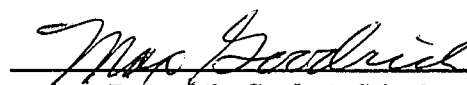
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Title of Thesis: The Relationship between Fixed-ratio Schedules of Reinforcement and Aggression in Children

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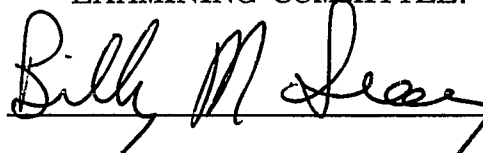


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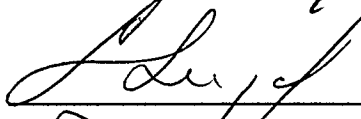


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